WATER RESOURCES REVIEW for

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

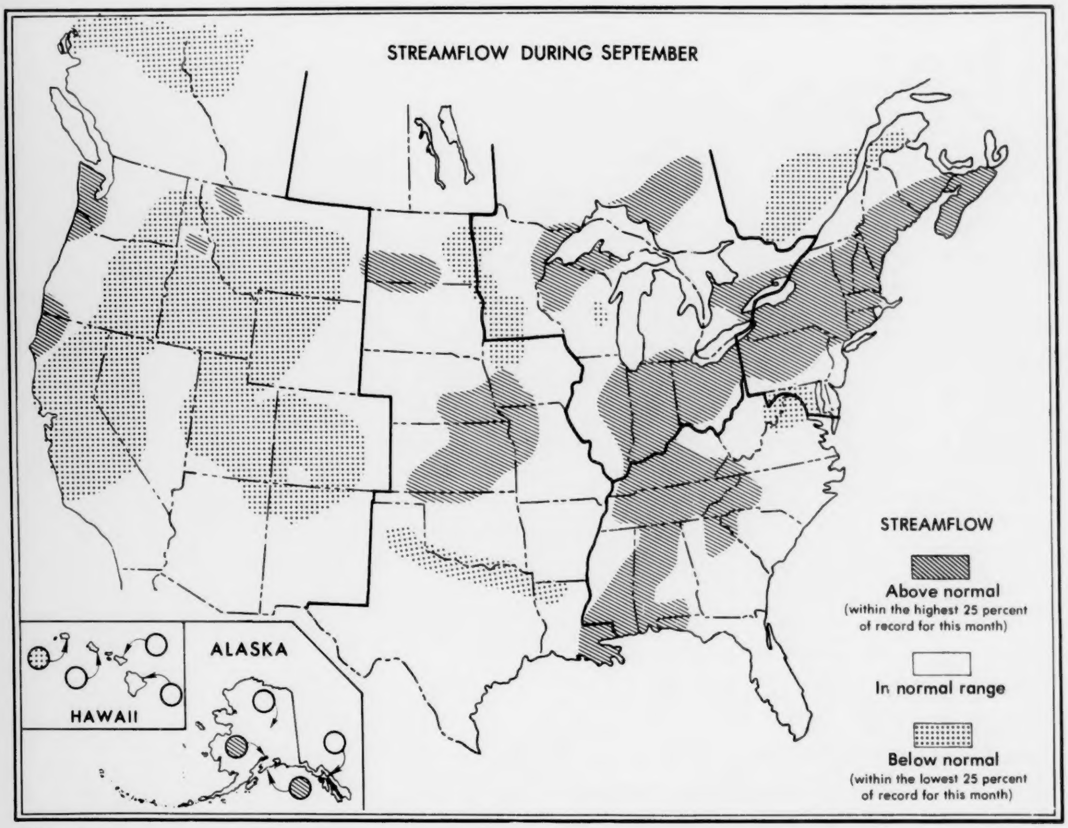
SEPTEMBER 1977

STREAMFLOW AND GROUND-WATER CONDITIONS

Streamflow generally decreased seasonally in southwestern Canada, several western States and Hawaii, and was variably up or down elsewhere. Drought conditions persisted in most western States, with monthly mean flows the lowest of record in parts of California, Colorado, and Utah. Monthly mean flows remained below the normal range in parts of each State in the West and also in parts of Iowa, Minnesota, North Dakota, and Virginia.

Monthly mean flows were above the normal range in large areas in central and eastern United States and in smaller areas in California, Idaho, Montana, Oregon, and Washington. Flows were highest of record in parts of Alaska, New York, North Dakota, and Louisiana. Flooding occurred in California, Illinois, Indiana, Kansas, Kentucky, Minnesota, Missouri, and North Carolina.

Ground-water levels declined along most of the central and southern parts of the Atlantic coastal areas (except for rises in southeastern Florida), and fell also in most of Michigan, West Virginia, Kentucky, Iowa, New Mexico, and southern Minnesota. Levels generally rose in New York State, Indiana, Alabama, Kansas, Nebraska, Utah, and northern Minnesota.



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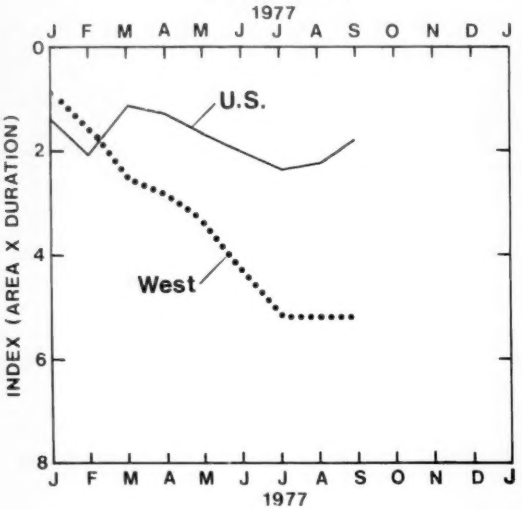
INDEX OF STREAMFLOW DEFICIENCY (Provisional)



The index of deficient streamflow for September indicates that the trend in the West has stabilized at 5.2 and that in the country as a whole, conditions have improved from an index reading of 2.2 in August to a reading of 1.8 in September. [Index = area of deficiency X monthly duration of deficiency.]

NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New Jersey, New York, Pennsylvania, and the New England States]

Streamflow generally increased except in Pennsylvania, Quebec, and the Atlantic Provinces, where flows in most index streams decreased. Monthly mean flow remained in the above-normal range in parts of Nova Scotia, Maine, Massachusetts, New Hampshire, New York, Pennsylvania, and Vermont, and increased into that range in parts of New Brunswick, Connecticut, and New Jersey. Flows remained in the below-normal range in western Maryland, and decreased into that range in parts of Quebec. Monthly mean flows were highest of record for September in parts of New York.

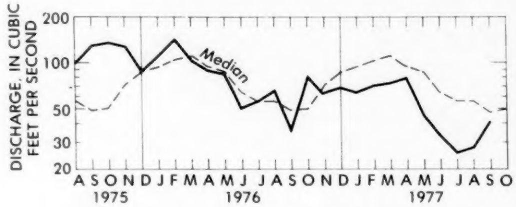
Ground-water levels were below average in most of Delaware, Maryland, and New Jersey, in contrast to unusually high levels for this time of year in parts of New York and Maine.

In south-central New York, the monthly mean discharge of 8,634 cfs in Susquehanna River at Conklin (drainage area 2,232 square miles), which was the result of increased runoff from rains near monthend, was greatest for September since records began in November 1912, and was 15 times the median flow for the month. In the eastern part of the State, flows in Hudson River at Hadley and Mohawk River at Cohoes also increased during the latter part of the month, were about 2 and 5 times the respective median flows for those sites, and were in the above-normal range. In northern New York, monthly mean flow in West Branch Oswegatchie River near Harrisville increased seasonally, remained above the normal range, and was about 2½ times median.

In Connecticut, flows also increased sharply as a result of increased runoff near monthend. In the northeastern part of that State, where monthly mean flow at the index station, Mount Hope River near Warrenville, normally is less in September than in August, flow increased contraseasonally and was about 8 times the median flow for September. Elsewhere in Connecticut, mean flows at the other index stations were 3 times median for the month, and were above the normal range.

In northwestern Pennsylvania, mean flow at the index station, Oil Creek at Rouseville, decreased seasonally but remained above the normal range for the 3d consecutive month, as a result of increased flow from rains of midmonth, and was 8 times the median flow for September. Also in northwestern Pennsylvania, monthly mean flow in Allegheny River at Natrona decreased seasonally but remained in the above-normal range for the 3d consecutive month, and was 6 times the September median discharge. In central Pennsylvania, flow in Susquehanna River at Harrisburg increased contraseasonally, was 5 times the median flow for the month, and was above the normal range.

Similarly, in northern New Jersey and the adjacent areas of New York and Pennsylvania, flow in Delaware River, as measured at Trenton, New Jersey, increased contraseasonally and was above the normal range. In the southern part of the State, monthly mean flow in Great Egg Harbor River at Folsom also increased contraseasonally and was in the normal range, after 9 consecutive months of below-normal mean flow. (See graph.)



Monthly mean discharge of Great Egg Harbor River at Folsom, N.J. (Drainage area, 56.3 sq mi; 146 sq km)

Flows increased seasonally at index stations in New Hampshire, Rhode Island, and Vermont, and decreased seasonally in Massachusetts. Monthly mean flow in Ware River at Coldbrook, Massachusetts, remained above the normal range, however, because of high carryover flow from August and increased flow from rains during September. In central Vermont, monthly mean discharge of White River at West Hartford increased sharply, was twice the median for September, and was above the normal range. Similarly, mean flow in Pemigewassett River at Plymouth, in central New Hampshire, increased sharply, was about 2½ times the September median flow, and was above the normal range. In northern Rhode Island, monthly mean flow in Branch River at Forestdale also increased sharply but remained within the normal range for the 4th consecutive month.

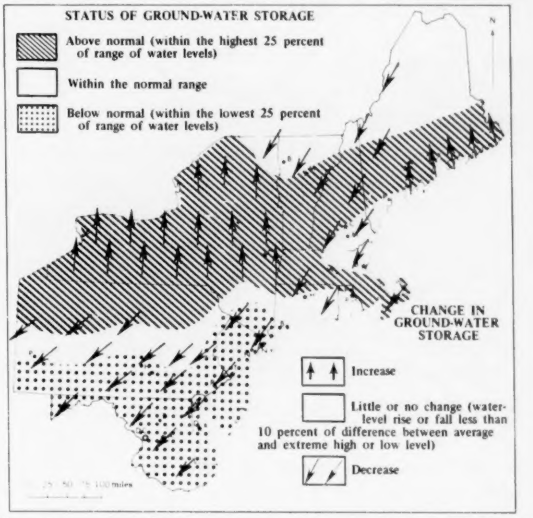
In central and southern parts of Maine, mean flows increased contraseasonally in Piscataquis River near Dover-Foxcroft and Little Androscoggin River near South Paris, were above the normal range, and were about 6 times the respective median flows for September. In northern Maine, monthly mean flow in St. John River below Fish River, at Fort Kent, decreased seasonally and remained within the normal range for the 5th consecutive month.

In northern parts of Nova Scotia and New Brunswick, monthly mean flows decreased and were in the normal range. In central Nova Scotia, mean flow in St. Marys River at Stillwater decreased contraseasonally but remained above the normal range for the 4th consecutive month and was 2 times the September median flow. In southern parts of Nova Scotia and New Brunswick, mean flows increased, were in the above-normal range, and were 2 to 4 times the median flows for the month.

In eastern Quebec, south of St. Lawrence River, monthly mean discharge in Matane River at Matane decreased contraseasonally, was below the normal range, and was less than one-half the September median flow. Also south of St. Lawrence River, in the southern part of the Province, mean flow in St. Francois River at Hemmings Falls increased seasonally and remained in the normal range. North of St. Lawrence River, and in southern Quebec, monthly mean flows in St. Maurice River at Grand Mere and Coulonge River near Fort Coulonge, decreased into the below-normal range and were about two-thirds the respective September median flows. Elsewhere in the Province, flows were in the normal range.

In the extreme southern part of the region, monthly mean flow in Potomac River near Washington, D.C., continued to decrease seasonally, remained below the normal range for the 5th consecutive month, and was 58 percent of the median flow for September. The minimum daily mean discharge of 1,350 cfs on the 30th was more than twice the record-low minimum daily mean for September, that occurred in 1930. In eastern Maryland, mean flow in Choptank River near Greensboro increased seasonally and was in the normal range, after 7 consecutive months of below-normal flow. Mean annual flow for 1977 water year at that station was below the normal range, was only 48 percent of median, and was 2d lowest for any water year since records began in 1948. In the western part of the State, mean flow in Seneca Creek at Dawsonville decreased seasonally and was below the normal range.

Ground-water levels rose in most of New York State (except in the southeastern part) and in some coastal areas in Maine; and generally declined elsewhere in the northeastern region. (See map.) Levels near end of month were above average in northern and central parts of the region, and were below average in most of Delaware, Maryland, and New Jersey, and also in southern Pennsylvania. Levels in parts of Maine, New York, and in a few other areas were at or near the highest levels for September in the past 20 years.



Map shows ground-water storage near end of September and change in ground-water storage from end of August to end of September.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

Streamflow generally decreased seasonally in Georgia and West Virginia, increased contraseasonally in North Carolina and Tennessee, and

was variable elsewhere in the region. Flows remained in the above-normal range in parts of Florida, Georgia, and Kentucky, and increased into that range in parts of Alabama, Mississippi, North Carolina, Tennessee, and Virginia. Monthly mean discharges remained in the below-normal range in parts of Virginia and decreased into that range in parts of West Virginia. Flooding occurred in parts of Kentucky and North Carolina.

Ground-water levels declined in most of the region, but rose in Alabama, north-central West Virginia, the western Piedmont of North Carolina, and in northern and southeastern Florida. Levels were far below average in some parts of Virginia.

Rapid runoff from local thunderstorms caused flooding along some small streams in Kentucky during the month. In the western part of the State, monthly mean discharge in Green River at Munfordville decreased seasonally but remained above the normal range as a result of high carryover flow from August, augmented by runoff from September storms. In eastern Kentucky, flow in Licking River at Catawba also decreased seasonally and was in the normal range.

In western North Carolina, minor flooding occurred on the 16th in Pigeon River and upper French Broad River basins. Monthly mean flow in French Broad River at Asheville increased contraseasonally and was above the normal range. In the north-central part of the State, flood-peak discharges with recurrence intervals of 5 to 10 years occurred on small streams in the central Piedmont counties of Alamance, Forsyth, Guilford, and Randolph on the 9th. In the eastern Piedmont and Coastal Plain, monthly mean flows were in the normal range.

In the Pee Dee River basin in eastern South Carolina and the adjacent area of North Carolina, monthly mean flow in Pee Dee River, as measured at Peedee, S.C., increased contraseasonally, was above median and in the normal range, after 4 consecutive months in the below-normal range. Also in eastern South Carolina, monthly mean flow of Lynches River at Effingham decreased seasonally and was in the normal range.

In northern Georgia, monthly mean discharge in Oconee River near Greensboro also decreased seasonally, but remained above the normal range as a result of high carryover flow from August, augmented by increased runoff near midmonth. In southern Georgia, flow in Alapaha River at Statenville increased contraseasonally and remained in the normal range. Elsewhere in the State, monthly mean discharges decreased seasonally and remained within the normal range.

In Shoal River basin in northwestern Florida and the adjacent area of Alabama, monthly mean discharge, as measured near Crestview, Fla., decreased contraseasonally but remained above the normal range. In west-central Florida, mean flow in Peace River at Arcadia increased seasonally and was in the normal range, after 5 consecutive months in the below-normal range. Elsewhere in the State, monthly mean discharges were within the normal range.

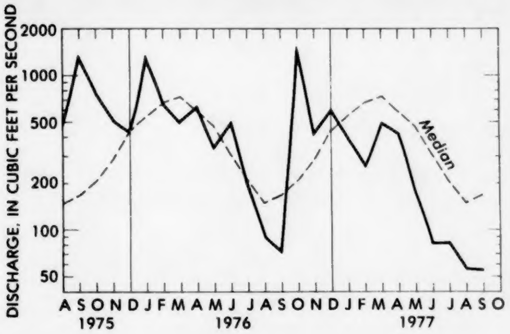
In northern Alabama, monthly mean flows in Tombigbee River at Demopolis lock and dam, near Coatopa, and Cahaba River at Centreville, increased contraseasonally and were above the normal range. In the southern part of the State, mean flow in Conecuh River at Brantley decreased seasonally and remained within the normal range.

In southeastern Mississippi, mean flow in Pascagoula River at Merrill increased contraseasonally, was 3½ times median and above the normal range. Also in southeastern Mississippi, and the adjacent area of Louisiana, mean flow in Pearl River, as measured at Bogalusa, La., increased contraseasonally, was twice the September median flow, and was above the normal range. In the northern part of the State, monthly mean flows were variable, increasing at some sites and decreasing at others, but were within the normal range.

In Tennessee, flows increased contraseasonally and were above the normal range in all parts of the State. In east-central Tennessee, mean flow in Emory River at Oakdale increased from 1½ times median in August to 16 times median in September. In the extreme eastern part of the State, mean flow in French Broad River below Douglas Dam also increased sharply and was 3 times the September median. In west-central Tennessee, monthly mean flows in Harpeth River near Kingston Springs and Duck River above Hurricane Mills increased into the above-normal range and were 2 to 4 times median, respectively.

In extreme western Virginia, mean flow in North Fork Holston River near Saltville increased contraseasonally and was above the normal range. In the northern part of the State, monthly mean discharge in Rapidan River near Culpeper decreased to $1/3$ of median and remained below the normal range for the 5th consecutive month. (See graph on page 5.)

In northern West Virginia, mean flow in Potomac River at Paw Paw continued to decrease seasonally, was



Monthly mean discharge of Rapidan River near Culpeper, Va.
(Drainage area, 472 sq mi; 1,222 sq km)

about one-half of the September median and was below the normal range. Elsewhere in the State, flows also decreased seasonally and were in the normal range.

Ground-water levels in West Virginia generally rose except in the north-central part. Levels were above average in the central part of the State, and below average elsewhere. In Kentucky, levels declined seasonally, but were above average except in heavily pumped areas. In downtown Louisville, levels continued the prevailing slow, upward trend. Levels in Virginia declined and were below average; in some wells, the levels were among the lowest of the past 20 to 30 years for end of September. In North Carolina, levels fell except for rises in the western Piedmont. Levels were above average in the mountains and western Piedmont, and were below average in the Coastal Plain and in the eastern Piedmont. In the Jackson, Mississippi, metropolitan area, levels continued to decline in wells screened in the heavily pumped Sparta Sand, again reaching record lows for the month. Levels in Alabama generally rose and remained above average. In the Piedmont area of Georgia, levels declined slightly. In the heavily pumped Brunswick and Savannah areas, levels were lower and higher respectively. In Florida, levels generally rose in the north and southeast, and declined to a new September low near Orlando in the central part of the State. End-of-month levels ranged from average to below average in nearly the entire State.

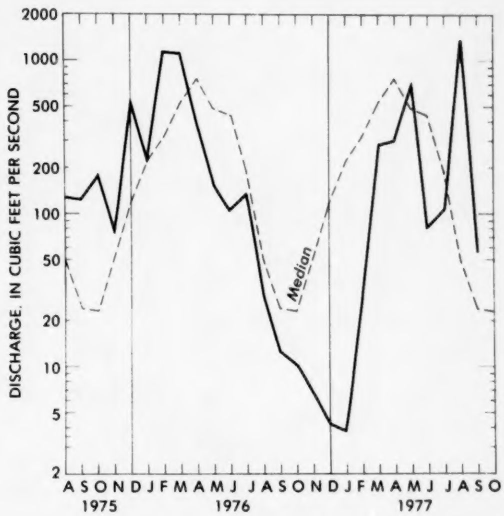
WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

Streamflow decreased seasonally in Indiana but was variable elsewhere in the region. Flows remained in the below-normal range in parts of Wisconsin and Minnesota. Above-normal flows persisted in Indiana and parts of Ohio and Illinois, and increased into that range in parts of Michigan, Minnesota, and Wisconsin. Flooding occurred in parts of Illinois, Indiana, Michigan, and Minnesota.

Ground-water levels generally declined in Michigan, southern Minnesota, and northeastern Ohio; and rose in most of Indiana, central Ohio, and northern Minnesota. Levels were below average in most wells in Minnesota, Michigan, and northeastern Ohio; and generally above average in Indiana.

In east-central Illinois, streamflow at Sangamon River at Monticello decreased seasonally but was nearly 24 times the median flow for September and remained in the above-normal range for the 2d consecutive month. (See graph.) A flash flood occurred in the north-side area



Monthly mean discharge of Sangamon River at Monticello, Ill.
(Drainage area, 550 sq mi; 1,424 sq km)

of Chicago on September 25 when extremely heavy rainfall fell in a short period of time. Elsewhere in the State, monthly mean flows generally decreased at the index stations with flows remaining in the normal range.

In Indiana, streamflow generally decreased seasonally although minor flooding occurred on the middle Wabash tributaries near the middle of the month. Monthly mean discharge at the index station, Wabash River at Mount Carmel, Illinois, decreased seasonally but remained in

(Continued on page 7.)

SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

(Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations above mean sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie, 1.57; Ontario, 1.22.)

Lake	September 30, 1977	Monthly mean, September		September		
		1977	1976	Average 1900–75	Maximum (year)	Minimum (year)
Superior (Marquette, Mich.)	601.38	601.09	601.13	601.02	601.93 (1916)	599.46 (1926)
Michigan and Huron (Harbor Beach, Mich.)	578.45	578.46	579.92	578.47	580.76 (1952)	575.94 (1964)
St. Clair (St. Clair Shores, Mich.)	574.37	574.17	575.12	573.51	575.70 (1973)	571.36 (1934)
Erie (Cleveland, Ohio)	571.68	571.50	572.11	570.44	572.51 (1973)	568.23 (1934)
Ontario (Oswego, N.Y.)	245.05	244.93	245.59	244.70	246.91 (1947)	241.94 (1934)

GREAT SALT LAKE

Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	September 30, 1977	September 30, 1976	Reference period 1904–76		
			September average, 1904–76	September maximum (year)	September minimum (year)
Elevation in feet above mean sea level:	4,198.90	4,200.40	4,197.7	4,203.7 (1923)	4,191.50 (1963)

LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

Alltime high (1827–1975): 102.1 (1869). Alltime low (1939–1975): 92.17 (1941).	September 29, 1977	September 30, 1976	Reference period 1939–75		
			September average, 1939–75	September max. daily (year)	September min. daily (year)
Elevation in feet above mean sea level:	95.84	96.62	94.54	96.75 (1972)	92.91 (1941)

FLORIDA

Site	September 1977		August 1977	September 1976
	Discharge in cfs	Percent of normal	Discharge in cfs	Discharge in cfs
Silver Springs near Ocala (northern Florida)	620	75	650	817
Miami Canal at Miami (southeastern Florida)	441	121	247	310
Tamiami Canal outlets, 40-mile bend to Monroe	960	169	187	796

(Continued from page 5.)

the above-normal range at over 2 times the median. Similarly, in the southeastern part of the State, flow in East Fork White River at Shoals decreased to 184 percent of median and remained in the above-normal range. Also, in eastern Indiana, monthly mean discharge in Mississinewa River at Marion was nearly three times the monthly median and remained in the above-normal range.

In eastern Ohio, monthly mean flow in Little Beaver Creek near East Liverpool continued to decrease seasonally but remained in the above-normal range for the 3d consecutive month at over 3 times the monthly median. In the northwestern part of the State, high carryover flow from August, augmented by above-normal runoff in September resulted in monthly mean flow in Maumee River at Waterville that was nearly 9 times the September median and well above the normal range.

In Michigan, monthly mean discharges returned to the normal range in the Lower Peninsula as a result of above-normal precipitation during September. In the Upper Peninsula, streamflow in Sturgeon River near Sidnaw increased sharply as a result of heavy rains at the beginning and near the end of the month, and was above the normal range at 310 percent of median.

In northern Wisconsin, streamflow increased sharply from the normal range to the above-normal range in Jump River at Sheldon (drainage area, 574 square miles) where the monthly mean of 1,062 cfs was 850 percent of median. Also, in northern Wisconsin, monthly mean flow at Chippewa River at Chippewa Falls increased sharply from the below-normal range to the above-normal range and was nearly 4 times the September median. In the east-central part of the State, monthly mean flow in Fox River at Rapide Croche Dam, near Wrightstown, decreased seasonally and remained in the below-normal range for the 5th consecutive month.

In northeastern Minnesota, a storm on September 23, 24, produced heavy rainfall in a narrow band along the north shore of Lake Superior extending from Duluth to the Canadian Border. Near-record floods occurred on many tributaries to Lake Superior. In the southwestern part of the State, the mean flow of 368 cfs in Minnesota River near Jordan (drainage area, 16,200 square miles) was one-third of the September median and below the normal range for the 6th consecutive month.

Ground-water levels in shallow water-table wells in Minnesota declined in the south, rose in the north, and remained below average throughout the State. In the heavily pumped, Minneapolis–St. Paul area, levels rose in the two principal aquifers, but remained below average. In Michigan also, levels remained below average. Levels generally declined except for slight rises in some shallow wells. In Indiana, levels continued a rising trend and were above average. Levels rose slightly in central Ohio, and continued to fall in the northeastern part of the State; and were below average in both areas, especially in the northeastern area.

MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

Streamflow generally decreased in Arkansas and South Dakota, increased in Manitoba, Saskatchewan, Missouri, North Dakota, and Oklahoma, and was variable elsewhere in the region. Monthly mean flows remained below the normal range in parts of Iowa, Louisiana, and North Dakota. Flows remained above the normal range in parts of Kansas and Louisiana, and increased into that range in parts of Iowa, North Dakota, and Missouri and were highest of record in parts of Louisiana and North Dakota. Severe flooding occurred in the Kansas City area of Missouri and Kansas.

Ground-water levels generally declined in Iowa, eastern North Dakota, and northern Louisiana; and rose in Kansas and Nebraska. Levels remained below average in most of North Dakota; were near average in northern Louisiana; and were generally above average in Iowa, Kansas, and Nebraska, except in heavily pumped areas.

Runoff from rains of as much as 16 inches in 48 hours at Independence, Missouri, and an official 8.82 inches in 24 hours at Kansas City caused devastating floods in northwestern Missouri and northeastern Kansas on September 13. More than 20 lives were lost in the flood, and preliminary damage estimates were about $50 million. Peak stages and discharges on many streams exceeded any previously known. Selected data on stages, discharges, recurrence intervals, and gaging-station locations are given in the accompanying table and map. Also, in the Grand River basin in northwestern Missouri, streamflow increased sharply and the monthly mean discharge of 4,468 cfs as measured near Gallatin (drainage area, 2,250 square miles) was over 25 times the monthly median. In adjacent Kansas, where monthly mean flow at the index station, Little Blue River near

Provisional data; subject to revision

FLOOD DATA FOR SELECTED SITES IN KANSAS AND MISSOURI, SEPTEMBER 1977

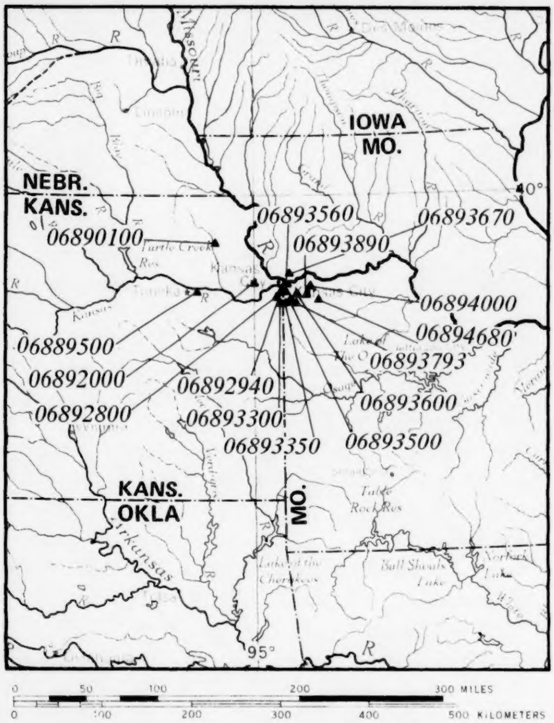
WRD station number	Stream and place of determination	Drainage area (square miles)	Period of known floods	Maximum flood previously known			Maximum during present flood				
				Date	Stage (feet)	Discharge (cfs)	Date	Stage (feet)	Discharge		Recurrence interval (years)
									Cfs	Cfs per square mile	
	KANSAS										
	KANSAS RIVER BASIN										
06889500	Soldier Creek near Topeka.	290	1929–32, 1935–	Oct. 11, 1973	[a]23.91	20,800	Sept. 13	21.5	20,000	69	50
06890100	Delaware River near Muscotah.	431	1969–	Oct. 11, 1973	[b]30.53	26,400	13	30.83	26,000	60	25
06892000	Stranger Creek near Tonganoxie.	406	1929–	July 12, 1951	[c]27.64	33,100	13	28.9	15,000	37	10
06892800	Turkey Creek at Merriam.	6.76	1974–	July 16, 1976	18.55	1,300	13	24.1	d	......	......
06892940	Turkey Creek at Kansas City.	22.3	1974–	June 24, 1976	16.31	d	13	26.7	12,000	538	100
	BLUE RIVER BASIN										
06893300	Indian Creek at Overland Park.	26.6	1963–	July 15, 1976	11.62	6,540	Sept. 13	15.5	9,400	353	100
06893350	Tomahawk Creek near Overland Park.	23.9	1970–	June 9, 1974	18.22	3,600	13	17.75	3,600	150	d
	MISSOURI										
	BLUE RIVER BASIN										
06893500	Blue River near Kansas City.	188	1939–	Sept. 13, 1961	44.46	41,000	Sept. 13	34.74	20,500	109	10
06893560	Brush Creek at Main St. in Kansas City.	14.8	1970–	June 28, 1976	7.90	4,300	13	22.2	16,600	1,122	......
	ROCK CREEK BASIN										
06893600	Rock Creek at Independence.	5.20	1967–	June 19, 1967	14.22	2,520	Sept. 13	16.7	10,000	1,923	......
06893670	Shoal Creek at Claycomo.	29.8	1976–	May 18, 1974	33.18	......	13	20.62	8,000	268	20
	LITTLE BLUE RIVER BASIN										
06893793	Little Blue River below Longview damsite in Kansas City.	50.7	1966–	June 27, 1969	.....	9,880	Sept. 13	21.07	18,600	367	......
06893890	East Fork Little Blue River near Blue Springs.	34.4	1970–	May 18, 1974	19.19	d	13	20.13	5,000	145	10
06894000	Little Blue River near Lake City.	184	1948–	Sept. 14, 1961	27.94	9,460	13	23.3	17,500	95	[e]1.3
06894680	SNI-A-BAR BASIN										......
	Sni-A-Bar Creek near Tarsney.	29.1	1970–	Sept. 11, 1975	21.93	4,300	Sept. 13	23.3	5,000	172	......

[a]Back water from Kansas River; maximum gage height, 25.06 ft, July 12, 1951, backwater from Kansas River.
[b]Flood in 1925 reached a stage of 36.5 ft, discharge not determined.
[c]Maximum stage, 28.70 ft, Oct. 13, 1961.
[d]Not determined.
[e]Ratio of discharge to that of a 100-year flood.

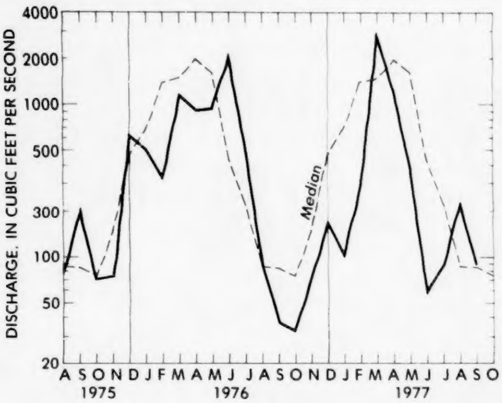
Barnes, was highest of record during August, streamflow during September decreased seasonally and, augmented by above-normal runoff during September, remained in the above-normal range.

In northern Arkansas, where mean discharge of Buffalo River near St. Joe was above the normal range and over 2½ times median in August, flow decreased seasonally to 105 percent of median and was within the normal range. (See graph.)

In southeastern Louisiana, streamflow was above the normal range as a result of heavy rains associated with Hurricane Babe during the period September 4–6. The monthly mean discharge of 5,733 cfs and the daily mean of 34,400 cfs on the 7th, in Amite River near Denham



Location of stream-gaging stations in Kansas and Missouri, described in table of peak stages and discharges

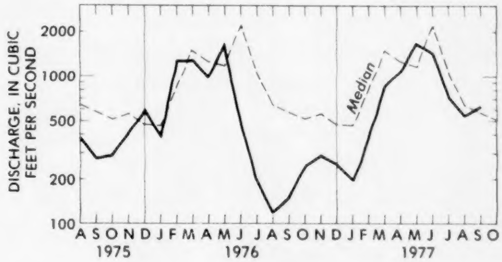


Monthly mean discharge of Buffalo River near St. Joe, Ark. (Drainage area, 829 sq mi; 2,147 sq km)

Springs (drainage area, 1,260 square miles) was highest for the month since records began in September 1938. The peak discharge of 36,700 cfs on the 7th was equivalent to that of a 4-year flood. Monthly mean flow in the Pearl River basin increased contraseasonally at the index station as measured near Bogalusa and was above the normal range. In the northwestern part of the State, streamflow decreased contraseasonally at the index station, Saline Bayou near Lucky, and remained in the below-normal range.

In southwestern Iowa, monthly mean flow at the index station, Nishnabotna River above Hamburg, increased sharply to over 4 times median and was above the normal range. Conversely, in the northwestern part of the State, mean flow at the index station, Des Moines River at Fort Dodge decreased seasonally to only 28 percent of median and remained in the below-normal range for the 18th consecutive month.

In northeastern Nebraska, streamflow increased contraseasonally at the index station, Elkhorn River at Waterloo, to 111 percent of the September median and remained in the normal range. (See graph.)



Monthly mean discharge of Elkhorn River at Waterloo, Nebr. (Drainage area, 6,900 sq mi; 17,900 sq km)

In southwestern North Dakota, the monthly mean discharge of 245 cfs and the daily mean of 2,080 cfs on the 24th, in Cannonball River at Breien (drainage area, 4,100 square miles), were highest for the month since records began in 1934. In the northeastern part of the State, in the Red River of the North basin, streamflow at Grand Forks (drainage area, 30,100 square miles) increased seasonally to 40 percent of the monthly median but remained in the below-normal range for the 13th consecutive month. A new daily minimum of 1.8 cfs on the 2d at Grand Forks was the result of repair work on a dam just upstream from the gage.

In southern Manitoba, mean flow in Waterhen River below Waterhen Lake increased contraseasonally and remained in the normal range. The level of Lake Winnipeg at Gimli averaged 711.66 feet above mean sea level and 2.20 feet below the long-term mean.

Ground-water levels dropped slightly in eastern North Dakota. They remained below average, including the lowest September level in the seventeen years of record in a 40-foot well near Wyndmere in Richland County, southeastern North Dakota. In Nebraska, levels rose in

most areas, and were above average except where affected significantly by pumping for irrigation or municipal supplies. Levels in Iowa declined in most shallow water-table wells, but were above average, including the highest September level in 37 years in a 15-foot observation well at Marion in Linn County in the eastern part of the State. In Kansas, levels generally rose in water-table wells, and were above average except in heavily pumped areas. In the rice-growing area of east-central Arkansas, levels fell slightly in the shallow aquifer, and rose more than 30 feet in the deep aquifer (Sparta Sand), reflecting the end of the rice-growing season; however, the level in the deep sand continued to be lowest of record (9 years) for the month. In the Sparta Sand, industrial aquifer of central and southern Arkansas, levels rose slightly at Pine Bluff and El Dorado. At Pine Bluff the level was the lowest for the month in 12 years of record. In southeastern Louisiana, levels in the Baton Rouge area declined in the "600-foot" sand but changed only slightly in other aquifers. In the Bogalusa area, levels rose in the shallow sand and in the "1,500-foot sand." In the Chicot aquifer in the southwestern part of the State, levels continued the upward recovery since the end of pumping (in June) for rice irrigation. In the north, levels declined in most aquifers. In Texas, levels declined at Austin (Edwards Limestone), El Paso (bolson deposits), and Houston (Evangeline aquifer), but rose at San Antonio (Edwards Limestone). Levels were above average at Austin and San Antonio, and below average at Houston and at an alltime low at El Paso. An alltime low was also recorded at Plainview in the Ogallala Formation.

WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

Streamflow generally increased seasonally in Idaho, Montana, and Washington, and decreased seasonally in Alberta, British Columbia, Arizona, New Mexico, and Utah. Contraseasonal increases in flow occurred in parts of California, Colorado, Oregon, and Utah. Monthly and daily mean flows were lowest of record for the month in parts of California, Colorado, and Utah, and daily mean flows were highest for the month in parts of California. Flows remained below the normal range in parts of each State except Arizona and Nevada, and decreased into the below-normal range in parts of Alberta and British Columbia. Monthly mean flows increased into the above-normal range in parts of California, Idaho, Montana, Oregon, and Washington. Flooding occurred in parts of California.

Ground-water levels generally rose in Utah and eastern Washington; fell or fluctuated only slightly in Idaho and southern California; and declined in New Mexico. Levels were mostly below average in Idaho, Utah, and New Mexico, and also in eastern Washington and southern California.

In north-coastal California, where monthly mean flow in Smith River near Crescent City (drainage area, 609 square miles) was below the normal range in 10 of the first 11 months of 1977 water year, runoff from intense rain resulted in a daily mean discharge of 3,400 cfs on the 28th—highest for September since records began in 1931. The monthly mean discharge of 411 cfs was in the above-normal range. Conversely, the annual mean runoff of 938 cfs for the water year ending September 30 was lowest of record and only 24 percent of median. At Redding, in the southern part of Shasta County in north-central California, runoff from rains September 18–20 (6.8 inches reported by National Weather Service) resulted in flood damage to streets and stores. In extreme southern California, the Metropolitan Water District of Southern California reported the emergency closing of the Colorado River Aqueduct on September 11 because of flood damage to the aqueduct and Fan Hills pumping plant about 12 miles east of Desert Hot Springs. The rapid runoff from the desert storm reportedly carried mud, debris, and boulders the size of pool tables, into the aqueduct system, resulting in the first closing in 36 years of operation. The 242-mile aqueduct had been carrying more than a billion gallons of water per day from Lake Havasu (on Colorado River at California-Arizona border) to Lake Matthews in Riverside City, about 50 miles west of Desert Hot Springs, and serving about 11 million people in the District. In the central part of the State, in the southern part of the Sierra Nevada, monthly mean flow in Kings River above North Fork, near Trimmer (drainage area, 952 square miles) continued to decrease seasonally and was below the normal range for the 17th time in the past 21 months. The monthly discharge of 93.2 cfs, and the daily mean of 85 cfs on the 26th, were lowest for the month in 48 years of record. Also, the annual mean discharge of 402 cfs for 1977 water year was lowest of record. In northern California, on the central Sierra Nevada east slope, monthly mean flow of West Walker River below Little Walker River, near Coleville (drainage

area, 180 square miles) remained below the normal range for the 18th time in the past 21 months. The monthly mean discharge of 10.9 cfs, and the daily mean discharge of 9 cfs on the 6th were lowest for September in 39 years of record. The annual mean discharge of 69.4 cfs for 1977 water year also was lowest of record. Also in northern California, but on the Sierra Nevada west slope, monthly mean flow in North Fork American River at North Fork Dam (drainage area, 342 square miles) was in the below-normal range for the 20th time in the past 21 months. The monthly mean discharge of 14.7 cfs was lowest for September in 66 years of record and the annual mean discharge of 88.4 cfs for 1977 water year, also was lowest of record. September rainfall produced little runoff to reservoirs and at monthend, contents of major reservoirs in northern California were only 32 percent of average and 47 percent of those of a year ago.

In central Colorado, east of the Continental Divide, the monthly mean discharge of 170 cfs, and the daily mean of 119 cfs on the 5th, in Arkansas River at Canon City (drainage area, 3,117 square miles) were lowest for the month in 89 years of record. Monthly mean flows were lowest of record in 5 months of the 1977 water year and the annual mean discharge of 313 cfs also was lowest of record. Also in central Colorado, but west of the Divide, monthly mean flow in Roaring Fork River at Glenwood Springs (drainage area, 1,451 square miles) increased contraseasonally but remained below the normal range for the 8th consecutive month. The annual mean discharge of 503 cfs for the water year ending September 30 was lowest in 71 years of record. Also west of the Divide, mean flow in Yampa River at Steamboat Springs increased contraseasonally and remained below the normal range for the 11th consecutive month, and the annual mean discharge for 1977 water year was lowest in 70 years of record. In southwestern Colorado, mean discharge in Animas River at Durango decreased seasonally and remained in the normal range. Annual mean discharge for 1977 water year was lowest in 72 years of record, as a result of 9 consecutive months of below-normal flows, starting in November 1976.

In southwestern Utah, the monthly mean discharge of 10.5 cfs, and the daily mean of 9.6 cfs, September 8–10, in Beaver River near Beaver (drainage area, 90.7 square miles), were lowest for the month since records began in March 1914. Flows at this index station have been below the normal range for 19 consecutive months. In northern Utah, mean flow in Weber River near Oakley continued to decrease seasonally, was 65 percent of median, and remained below the normal range for the 13th consecutive month. Also in northern Utah, mean flow in Big Cottonwood Creek near Salt Lake City continued to decrease seasonally, and remained in the below-normal range. In eastern Utah, and the adjacent area of Colorado, monthly mean flow in Colorado River, as measured near Cisco, Utah, (drainage area, 24,100 square miles) increased contraseasonally but remained below the normal range for the 8th consecutive month. The annual mean discharge of 2,055 cfs for 1977 water year was lowest in 66 years of record.

In central Idaho, runoff from heavy precipitation in the Solway and Lochsa River basins (tributaries to Clearwater River) resulted in a sharp increase in monthly mean flow in Clearwater River at Spalding, into the above-normal range, following 10 consecutive months of below-normal flow. Elsewhere in the State, mean flows remained in the below-normal range, except in Kootenai River where flow was in the normal range. Annual mean discharges for 1977 water year were lowest in 83 years of record in Boise River, in 66 years in Weiser River, in 65 years in Clearwater and Salmon Rivers, and in 58 years in Coeur d'Alene River. Similarly, total monthend reservoir storage for irrigation was lowest of record.

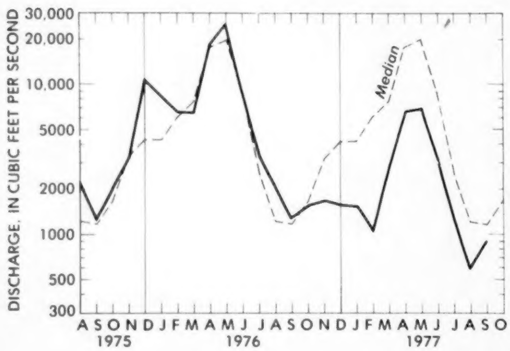
In Montana, monthly mean flows increased contraseasonally at all index stations except Yellowstone River at Corwin Springs, where flow continued to decrease seasonally and remained below the normal range for the 5th consecutive month. Downstream, mean flow in Yellowstone River at Billings increased contraseasonally but remained below the normal range. In northwestern Montana, monthly mean discharge in Marias River near Shelby also increased contraseasonally but remained within the normal range. Also in the northwestern part of the State, west of the Continental Divide, mean flow in Middle Fork Flathead River near West Glacier increased contraseasonally and was in the above-normal range. Nine of the preceding 11 months were in the below-normal range. Also west of the Divide, monthly mean flow in Clark Fork at St. Regis increased contraseasonally and remained in the below-normal range for the 9th consecutive month. Annual mean discharges for 1977 water year were below the normal range at all index stations in the State.

In northern Wyoming, mean flow in Tongue River near Dayton continued to decrease seasonally and remained below the normal range for the 4th consecutive month. Elsewhere in the State, flows were in the normal range.

In eastern Oregon, monthly mean flow in John Day River at Service Creek increased seasonally but remained below the normal range for the 11th consecutive month.

In southwestern Oregon, mean flow in Umpqua River near Elkton increased contraseasonally and was in the normal range. In north-coastal Oregon, monthly mean flow in Wilson River near Tillamook increased contraseasonally and was in the above-normal range. The annual mean discharge for 1977 water year was below the normal range at each index station in the State.

In the lowlands of western Washington, monthly mean flow in Chehalis River near Grand Mound increased seasonally and remained above the normal range. The annual mean discharge for 1977 water year was lowest in the 49-year record because 6 of the first 7 monthly mean discharges in the year were below the normal range and 4 of the 6 were less than one-fourth median. In eastern Washington, mean flow in Spokane River at Spokane increased contraseasonally but remained below the normal range for the 11th consecutive month. (See graph.) The annual mean discharge of 2,514 cfs for the 1977 water year was only 36 percent of median and was lowest in record that began in 1891. Monthend storage in major reservoirs was near average.



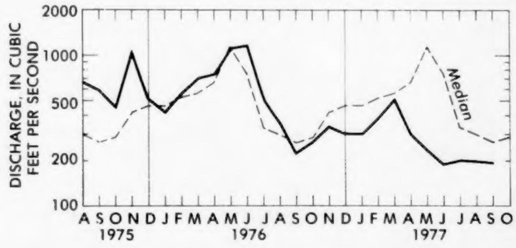
Monthly mean discharge of Spokane River at Spokane, Wash. (Drainage area, 4,290 sq mi; 11,100 sq km)

In Nevada, mean flow at the index station, Humboldt River at Palisade, continued to decrease seasonally but remained in the normal range.

In Alberta, monthly mean discharge in Athabasca River at Hinton continued to decrease seasonally and was below the normal range.

In northern British Columbia, monthly mean flow in Skeena River at Usk decreased sharply and was below the normal range for the 2d time in the 1977 water year. In the southern part of the Province, monthly mean discharge in Fraser River at Hope also decreased seasonally but remained in the normal range.

In northern New Mexico, monthly mean flow in Rio Grande below Taos Junction Bridge, near Taos, decreased seasonally and remained in the below-normal range for the 6th consecutive month, and for the 9th time in the past 10 months. (See graph.) Elsewhere in the State, flows also decreased seasonally but were within the normal range.



Monthly mean discharge of Rio Grande below Taos Junction Bridge, near Taos, N. Mex. (Drainage area, 9,730 sq mi; 25,200 sq km)

In Arizona, mean flows decreased seasonally and were in the normal range at all index stations.

Contents of the Colorado River Storage Project decreased 810,430 acre-feet during the month.

Ground-water levels in the Spokane area of eastern Washington rose, but remained below average. In Idaho, levels in most wells declined or changed only slightly, and were below average. The level in each key well representative of the Snake River Plain aquifer in the southern part of the State was near the minimum of record for September. In southern California, levels in key observation wells declined or fluctuated only slightly, and remained below average. The level in the 290-foot well tapping alluvial sand and gravel in the upper Cuyama Valley, Santa Barbara County, fell 7 feet to an alltime low (28 years of record), just barely lower than the previous alltime low of July 1957. In Nevada, levels fell at Paradise and Steptoe (near north-central and east-central State borders, respectively); and rose at Las Vegas (south) and Truckee Meadows (near west-central border). Levels remained below average at three of the four wells, and continued above average in the Steptoe Valley. Levels rose in most wells in Utah, but fell at Blanding in the southeastern part of the State. Levels remained below average in most of Utah. In southern Arizona, the level continued to fall to alltime lows in the Tucson no. 2 observation well, and was lowest of record also in the Elfrida area, Cochise County. In New Mexico, levels generally declined and remained below average. An exception to this trend was the rising level in the 132-foot Hrna water-table well, near Deming, Luna County, tapping bolson deposits in the southwestern part of the State. However, the level remained far below average. A new, lowest-September level of record was

reached in the 250-foot Dayton well, tapping alluvial deposits in the southern part of the Roswell basin, Eddy County, in southeastern Arizona.

ALASKA

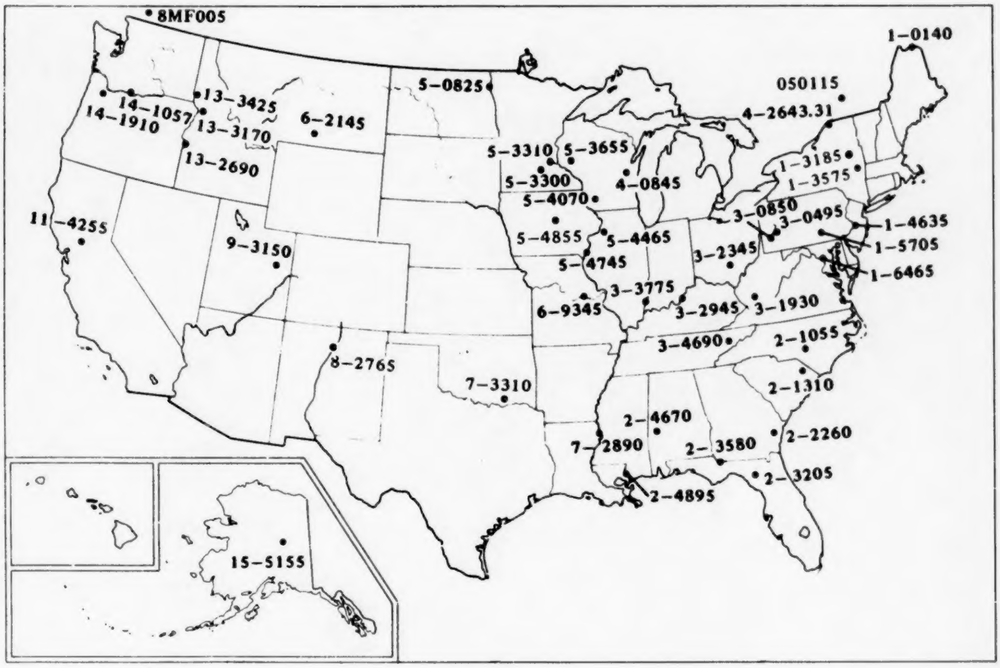
Streamflow was variable throughout the State and was generally higher than normal because of above-average precipitation, including last winter's record-maximum snowpack in the south-central part of the State. Monthly mean flow at the index station, Kenai River at Cooper Landing (drainage area, 634 square miles), decreased seasonally but remained in the above-normal range for the 4th consecutive month. The yearly mean of 4,500 cfs was highest in 30 years of record for that site. Downstream at Soldotna (drainage area, 2,010 square miles) the Kenai River reached a stage of 13.45 feet and a discharge of 33,700 cfs (the highest since records began in 1965), as a result of glacier-dammed lake outburst floods on the Snow River and Skilak River in early September. Also in south-central Alaska, mean flow at Little Susitna River near Palmer increased contraseasonally and was above the normal range as a result of heavy rains during the month. Elsewhere in the State, mean flows were generally in the normal range.

Ground-water levels in the Anchorage area rose two feet or more in the confined aquifers (mainly because of reductions in pumping of municipal wells), except near the Chugach foothills where levels were stable or declined slightly. Levels in shallow water-table wells changed very slightly.

HAWAII

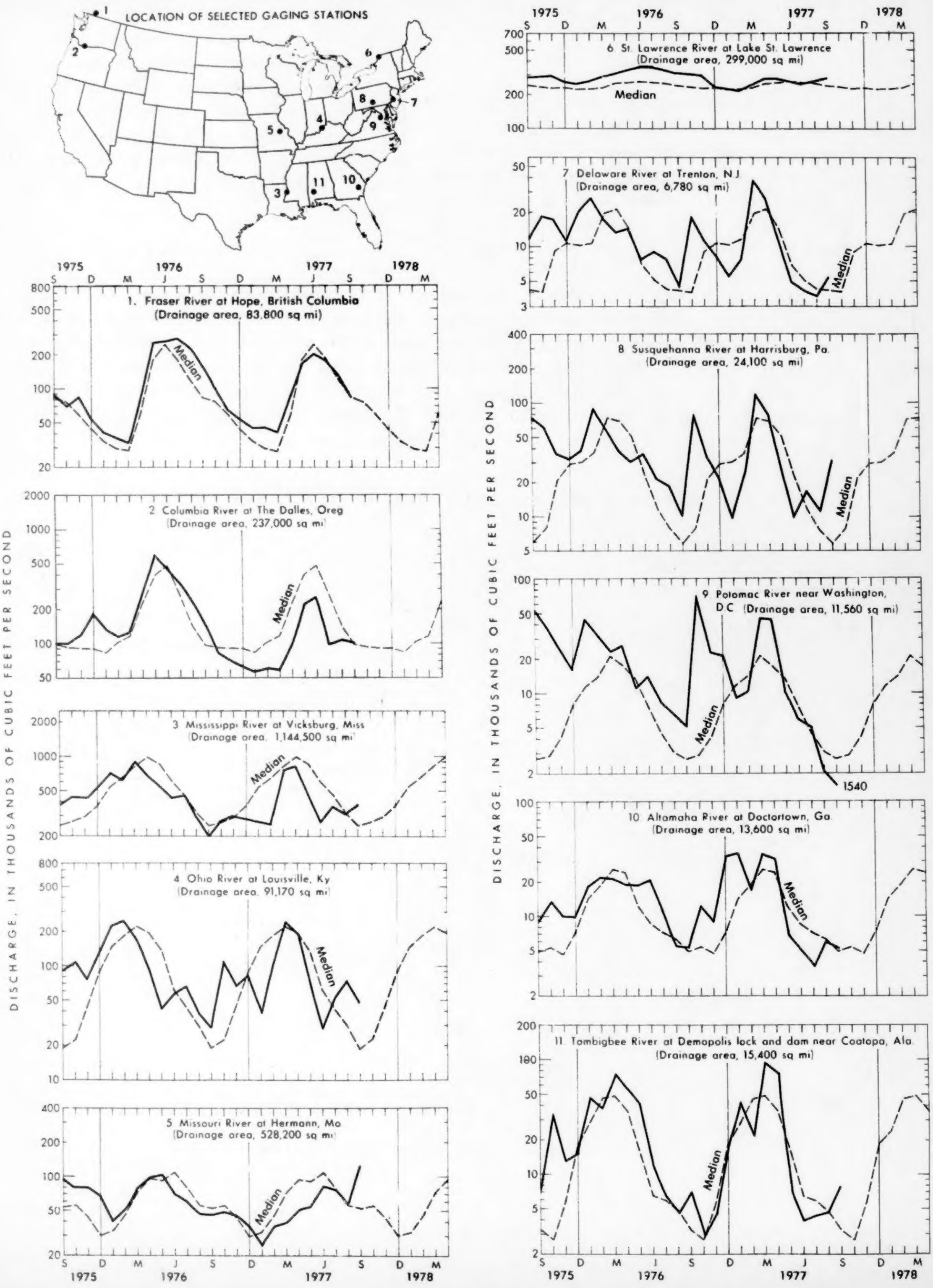
Streamflow generally decreased seasonally throughout the State. In the western part of the State, monthly mean flow of East Branch of North Fork Wailua River near Lihue (island of Kauai) remained in the below-normal range at 50 percent of median. Elsewhere in the State, streamflows were generally in the normal range.

SELECTED STREAM-GAGING STATIONS ON LARGE RIVERS



Location of stream-gaging stations on large rivers listed in table on page 15.

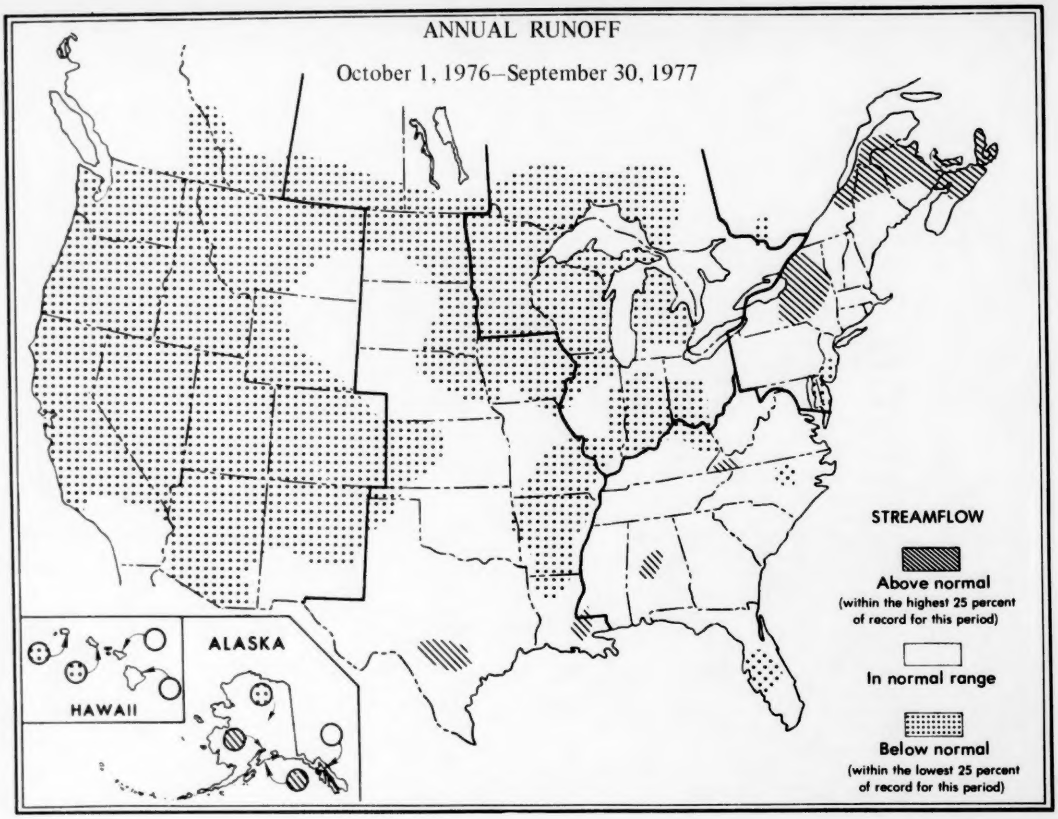
HYDROGRAPHS OF SOME LARGE RIVERS, SEPTEMBER 1975 TO SEPTEMBER 1977

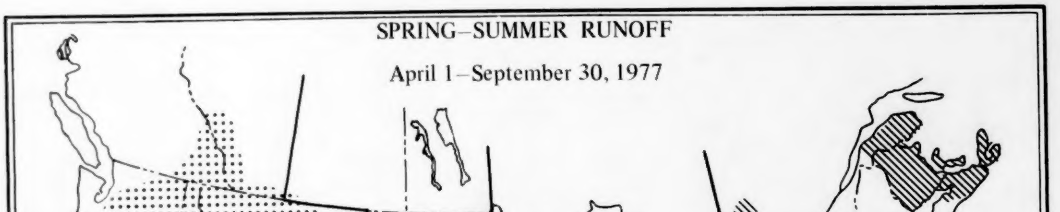


FLOW OF LARGE RIVERS DURING SEPTEMBER 1977

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1970 (cfs)	September 1977					
				Monthly dis-charge (cfs)	Percent of median monthly discharge, 1941–70	Change in dis-charge from previous month (percent)	Discharge near end of month		
							(cfs)	(mgd)	Date
1–0140	St. John River below Fish River at Fort Kent, Maine.	5,690	9,397	4,017	120	-8	8,250	5,330	30
1–3185	Hudson River at Hadley, N.Y	1,664	2,791	2,475	227	+109	8,000	5,200	30
1–3575	Mohawk River at Cohoes, N.Y	3,456	5,450	7,675	479	+304	....	....	.....
1–4635	Delaware River at Trenton, N.J	6,780	11,360	5,446	130	+44	9,130	5,900	25
1–5705	Susquehanna River at Harrisburg, Pa.	24,100	33,670	31,050	528	+176	76,000	49,100	30
1–6465	Potomac River near Washington, D.C.	11,560	[1]10,640	1,540	58	-25	1,350	870	30
2–1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	4,847	3,107	170	+153	680	440	30
2–1310	Pee Dee River at Peedee, S.C	8,830	9,098	6,570	139	+86	5,070	3,280	29
2–2260	Altamaha River at Doctortown, Ga.	13,600	13,380	5,196	106	-13	5,230	3,380	28
2–3205	Suwannee River at Branford, Fla	7,740	6,775	3,920	70	+33	3,860	2,490	29
2–3580	Apalachicola River at Chattahoochee, Fla.	17,200	21,690	11,700	96	0	11,200	7,240	29
2–4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	21,700	7,793	239	+72	3,450	2,230	26
2–4895	Pearl River near Bogalusa, La	6,630	8,533	4,523	200	+34	3,460	2,240	30
3–0495	Allegheny River at Natrona, Pa	11,410	[1]18,700	16,061	588	-28	48,300	31,200	26
3–0850	Monongahela River at Braddock, Pa.	7,337	[1]11,950	3,547	119	-46	3,050	1,970	26
3–1930	Kanawha River at Kanawha Falls, W.Va.	8,367	12,370	4,024	126	-31	2,930	1,890	27
3–2345	Scioto River at Higby, Ohio	5,131	4,337	1,085	180	+9	1,090	700	27
3–2945	Ohio River at Louisville, Ky[2]	91,170	110,600	47,507	251	-36	79,700	51,500	27
3–3775	Wabash River at Mount Carmel, Ill.	28,600	26,310	14,780	232	-24	12,800	8,270	30
3–4690	French Broad River below Douglas Dam, Tenn.	4,543	[1]6,528	7,655	285	+141	....	....	.....
4–0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[2]	6,150	4,142	1,230	57	-12	....	....	.....
02MC002 (4–2643.31)	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y.[3]	299,000	239,100	276,500	114	+6	287,000	185,000	30
050115	St. Maurice River at Grand Mere, Quebec.	16,300	24,900	11,800	69	-24	17,600	11,400	30
5–0825	Red River of the North at Grand Forks, N. Dak.	30,100	2,439	540	40	+132	1,000	650	30
5–3300	Minnesota River near Jordan, Minn ..	16,200	3,306	368	33	-13	354	230	26
5–3310	Mississippi River at St. Paul, Minn ...	36,800	[1]10,230	6,140	97	+229	5,950	3,850	25
5–3655	Chippewa River at Chippewa Falls, Wis.	5,600	5,062	11,490	381	+416	....	....	.....
5–4070	Wisconsin River at Muscoda, Wis	10,300	8,457	4,334	75	+34	....	....	.....
5–4465	Rock River near Joslin, Ill	9,520	5,288	3,083	120	-11	3,300	2,130	30
5–4745	Mississippi River at Keokuk, Iowa ...	119,000	61,210	55,233	134	+64	65,500	42,300	30
5–4855	Des Moines River below Raccoon River at Des Moines, Iowa.	9,879	3,796	1,659	158	+41	1,500	970	30
6–2145	Yellowstone River at Billings, Mont.	11,795	6,754	3,246	81	+23	3,180	2,060	30
6–9345	Missouri River at Hermann, Mo	528,200	78,480	121,600	231	+113	98,300	63,500	23
7–2890	Mississippi River at Vicksburg, Miss.[4]	1,144,500	552,700	377,800	152	+22	505,000	326,000	30
7–3310	Washita River near Durwood, Okla ..	7,202	1,379	312	61	+2	175	113	30
8–2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex.	9,730	732	189	71	-5	189	120	30
9–3150	Green River at Green River, Utah ...	40,600	6,369	1,101	48	-5	2,040	1,320	30
11–4255	Sacramento River at Verona, Calif ...	21,257	18,370	6,207	63	-6	5,000	3,200	27
13–2690	Snake River at Weiser, Idaho	69,200	17,670	8,931	71	+27	10,600	6,850	26
13–3170	Salmon River at White Bird, Idaho ..	13,550	11,060	3,658	83	+11	4,740	3,060	26
13–3425	Clearwater River at Spalding, Idaho ..	9,570	15,320	4,275	141	-7	7,120	4,600	26
14–1057	Columbia River at The Dalles, Oreg.[5]	237,000	194,000	100,000	103	-7	....	....	.....
14–1910	Willamette River at Salem, Oreg	7,280	23,370	4,329	109	+77	11,700	7,560	26–30
15–5155	Tanana River at Nenana, Alaska	25,600	24,040	32,200	103	-47	26,900	17,400	30
8MF005	Fraser River at Hope, British Columbia.	83,800	95,300	82,800	100	-36	71,000	45,900	30

[1] Adjusted.
[2] Records furnished by Corps of Engineers.
[3] Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5] Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.
*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1–3185 is 01318500.


ANNUAL RUNOFF
October 1, 1976–September 30, 1977
HAWAII
ALASKA
STREAMFLOW
Above normal
(within the highest 25 percent of record for this period)
In normal range
Below normal
(within the lowest 25 percent of record for this period)


SPRING–SUMMER RUNOFF
April 1–September 30, 1977
HAWAII
ALASKA
STREAMFLOW
Above normal
(within the highest 25 percent of record for this period)
In normal range
Below normal
(within the lowest 25 percent of record for this period)

Provisional data; subject to revision

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF SEPTEMBER 1977

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Principal uses: F–Flood control; I–Irrigation; M–Municipal; P–Power; R–Recreation; W–Industrial

Reservoir	End of Aug. 1977	End of Sept. 1977	End of Sept. 1976	Average for end of Sept.	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	71	64	54	38	226,300 (a)
QUEBEC					
Allard (P)	79	77	87	59	280 600 ac-ft
Gouin (P)	81	80	86	65	6,954,000 ac-ft
MAINE					
Seven reservoir systems (MP)	75	71	83	57	178,500 mcf
NEW HAMPSHIRE					
First Connecticut Lake (P)	87	49	51	79	3,330 mcf
Lake Francis (FPR)	79	32	80	77	4,326 mcf
Lake Winnipesaukee (PR)	83	80	75	63	7,200 mcf
VERMONT					
Harriman (P)	72	27	67	64	5,060 mcf
Somerset (P)	71	85	71	72	2,500 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	75	75	75	74	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	66	68	79	62	34,270 mcf
Indian Lake (FMP)	100	106	215	57	4,500 mcf
New York City reservoir system (MW)	76	72	83	.....	547,500 mg
NEW JERSEY					
Wanaque (M)	63	51	77	69	27,730 mg
PENNSYLVANIA					
Allegheny (FPR)	47	64	40	39	51,400 mcf
Pymatuning (FMR)	101	95	88	80	8,191 mcf
Raystown Lake (FR)	67	66	65	52	33,190 mcf
Lake Wallenpaupack (PR)	64	48	62	56	6,875 mcf
MARYLAND					
Baltimore municipal system (M)	80	72	93	86	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	82	89	90	90	12,580 mcf
Narrows (Badin Lake) (P)	96	92	97	98	5,617 mcf
High Rock Lake (P)	60	73	71	64	10,230 mcf
SOUTH CAROLINA					
Lake Murray (P)	78	80	78	66	70,300 mcf
Lakes Marion and Moultrie (P)	70	73	86	66	81,100 mcf
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	62	62	68	56	75,360 mcf
GEORGIA					
Burton (PR)	89	87	89	77	104,000 ac-ft
Sinclair (MPR)	90	82	82	80	214,000 ac-ft
Lake Sidney Lanier (FMPR)	53	50	55	55	1,686,000 ac-ft
ALABAMA					
Lake Martin (P)	86	84	85	76	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	42	36	34	38	1,156,000 cfsd
Douglas Lake (FPR)	31	39	32	33	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	68	61	66	58	510,300 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	46	44	44	44	1,452,000 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	63	59	51	57	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	71	94	63	72	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	48	69	25	63	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	19	26	14	32	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	78	78	92	.....	22,640,000 ac-ft
SOUTH DAKOTA					
Angostura (I)	59	48	60	73	127,600 ac-ft
Belle Fourche (I)	23	15	5	32	185,200 ac-ft
Lake Francis Case (FIP)	73	70	78	68	4,834,000 ac-ft
Lake Oahe (FIP)	75	72	81	.....	22,530,000 ac-ft
MIDCONTINENT REGION--Continued					
SOUTH DAKOTA--Continued					
Lake Sharpe (FIP)	103	103	101	99	1,725,000 ac-ft
Lewis and Clarke Lake (FIP)	96	96	96	98	477,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	63	62	62	66	1,948,000 ac-ft
OKLAHOMA					
Eufaula (FPR)	89	92	75	79	2,378,000 ac-ft
Keystone (FPR)	109	99	69	97	661,000 ac-ft
Tenkiller Ferry (FPR)	95	94	87	88	628,200 ac-ft
Lake Altus (FIMR)	70	71	58	46	134,500 ac-ft
Lake O'The Cherokees (FPR)	85	90	77	81	1,492,000 ac-ft
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	96	96	93	92	2,722,000 ac-ft
TEXAS					
Bridgeport (IMW)	85	80	88	45	386,400 ac-ft
Canyon (FMR)	90	90	90	71	385,600 ac-ft
International Amistad (FIMPW)	101	95	100	75	3,497,000 ac-ft
International Falcon (FIMPW)	87	93	100	73	2,667,000 ac-ft
Livingston (IMW)	94	96	100	77	1,788,000 ac-ft
Possum Kingdom (IMPRW)	92	90	96	102	569,400 ac-ft
Red Bluff (PI)	9	6	21	24	307,000 ac-ft
Toledo Bend (P)	86	80	83	79	4,472,000 ac-ft
Twin Buttes (FIM)	82	77	91	22	177,800 ac-ft
Lake Kemp (IMW)	76	72	63	87	268,000 ac-ft
Lake Meredith (FMW)	39	40	40	43	821,300 ac-ft
Lake Travis (FIMPRW)	84	77	90	76	1,144,000 ac-ft
THE WEST					
WASHINGTON					
Ross (PR)	78	79	99	91	1,052,000 ac-ft
Franklin D. Roosevelt Lake (IP)	100	92	94	97	5,232,000 ac-ft
Lake Chelan (PR)	87	79	93	85	676,100 ac-ft
Lake Cushman	79	86	95	91	359,500 ac-ft
Lake Merwin (P)	107	102	104	92	246,000 ac-ft
IDAHO					
Boise River (4 reservoirs) (FIP)	18	13	54	48	1,235,000 ac-ft
Coeur d'Alene Lake (P)	90	77	79	64	238,500 ac-ft
Pend Oreille Lake (FP)	98	88	91	92	1,561,000 ac-ft
IDAHO--WYOMING					
Upper Snake River (8 reservoirs) (MP)	16	13	54	48	4,401,000 ac-ft
WYOMING					
Boysen (FIP)	62	59	92	84	802,000 ac-ft
Buffalo Bill (IP)	52	45	77	81	421,300 ac-ft
Keyhole (F)	60	57	67	42	199,900 ac-ft
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	44	38	55	41	3,056,000 ac-ft
COLORADO					
John Martin (FIR)	0	0	0	13	364,400 ac-ft
Taylor Park (IR)	50	44	62	59	106,200 ac-ft
Colorado--Big Thompson project (I)	29	24	52	59	722,600 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Navajo, and Blue Mesa Reservoirs (IFPR)	65	62	80	.....	31,280,000 ac-ft
UTAH--IDAHO					
Bear Lake (IPR)	56	55	82	58	1,421,000 ac-ft
CALIFORNIA					
Folsom (FIP)	17	15	42	59	1,000,000 ac-ft
Hetch Hetchy (MP)	37	32	35	57	360,400 ac-ft
Isabella (FIR)	7	7	12	25	551,800 ac-ft
Pine Flat (FI)	7	7	20	35	1,014,000 ac-ft
Clair Engle Lake (Lewiston) (P)	14	10	62	77	2,438,000 ac-ft
Lake Almanor (P)	59	52	57	50	1,036,000 ac-ft
Lake Berryessa (FIMW)	49	48	65	79	1,600,000 ac-ft
Millerton Lake (FI)	38	39	43	33	503,200 ac-ft
Shasta Lake (FIPR)	13	14	29	67	4,377,000 ac-ft
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	6	0	42	55	744,600 ac-ft
NEVADA					
Rye Patch (I)	37	33	69	76	157,200 ac-ft
ARIZONA--NEVADA					
Lake Mead and Lake Mohave (FIMP)	75	77	78	70	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	0	1	0	11	1,073,000 ac-ft
Salt and Verde River system (IMPR)	26	26	49	35	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	34	33	24	79	352,600 ac-ft
Elephant Butte and Caballo (FIPR)	6	5	13	22	2,539,000 ac-ft

[a] Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

DISSOLVED SOLIDS AND WATER TEMPERATURES FOR SEPTEMBER AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	September data of following calendar years	Stream discharge during month	Dissolved-solids concentration during month[a]		Dissolved-solids discharge during month[a]			Water temperature during month[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean (tons per day)	Minimum (tons per day)	Maximum (tons per day)	Mean, in °C	Minimum, in °C	Maximum, in °C
	NORTHEAST										
01463500	Delaware River at Trenton, N.J.	1977*	5,446	......	......	......	......	......	......	......	......
	(Morrisville, Pa.)	1945–76	5,571	71	149	......	523	6,700	......	14.0	32.0
		(Extreme yr)		(1945)	(1965)		(1966)	(1974)			
			[4,176[c]]								
04264331	St. Lawrence River at Cornwall, Ontario, near	1977	277,000	167	169	125,000	120,000	130,000	19.5	17.0	21.5
		1975–76	295,000	166	168	133,000	126,000	142,000	18.5	15.0	21.0
	Massena, N.Y. (streamflow station formerly at Ogdensburg, N.Y.)	(Extreme yr)		(1976)	(1975)		(1975)	(1976)		(1975)	(1975)
			[242,000[c]]								
	SOUTHEAST										
07289000	Mississippi River at Vicksburg, Miss	1977	377,800	185	229	215,000	172,000	272,000	26.5	23.5	29.5
		1975–76	286,000	236	272	197,000	116,000	293,000	26.0	21.0	30.0
		(Extreme yr)		(1975)	(1975)		(1976)	(1975)		(1975)	(1975)
			[248,200[c]]								
	WESTERN GREAT LAKES REGION										
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill.	1977	189,000	148	242	......	117,000	67,100	......	25.0	29.5
	(25 miles west of Paducah,	1955–76	100,000	117	314	......	9,190	304,000	......	17.0	28.5
	Ky.; streamflow station at Metropolis, Ill.)	(Extreme yr)		(1965)	(1965)		(1961)	(1975)			
			[78,480[c]]								
	MIDCONTINENT										
06934500	Missouri River at Hermann,	1977	127,000	204	354	87,900	48,200	154,000	23.0	21.0	25.0
	Mo. (60 miles west of St.	1975–76	68,050	313	445	73,700	46,900	128,000	23.0	18.0	27.0
	Louis, Mo.)	(Extreme yr)		(1975)	(1975)		(1976)	(1975)		(1975)	(1975)
			[52,580[c]]								
	WEST										
14128910	Columbia River at	1977	96,600	98	102	26,100	17,700	33,300	18.5	17.0	19.5
	Warrendale, Oreg.	1975–76	136,600	73	95	30,200	22,700	50,300	19.5	17.5	21.0
	(30 miles east of Portland, Oreg.; streamflow station at The Dalles, Oreg.)	(Extreme yr)		(1976)	(1975)		(1976)	(1976)		(1976)	(1975)
			[105,200[c]]								

[a]Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: $[(1.8 \times °C) + 32] = °F$.
[c]Median of monthly values for 30-year reference period, water years 1941–70, for comparison with data for current month.
*Dissolved-solids and water-temperature records not available.

DISSOLVED SOLIDS AND WATER TEMPERATURES FOR SEPTEMBER ON SIX LARGE RIVERS

The table at left shows dissolved-solids and temperature data for September at six stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). NASQAN, as established by the U.S. Department of the Interior, Geological Survey, is designed to describe the water quality of the Nation's streams and rivers on a systematic and continuing basis, so as to meet many of the information needs of those involved in national or regional water-quality planning and management.

"Dissolved solids," as described in several columns of the table, are minerals dissolved in water and usually consist predominantly of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. These same minerals are among the most common components of the Earth's solid rocks and minerals, but gradually erode and at least partly dissolve as a part of natural weathering processes. Collectively these and other dissolved minerals constitute the dissolved-solids concentration expressed in milligrams per liter (mg/L) or the generally equivalent expression, parts per million (parts of dissolved matter in one million parts of water, by weight). Values of dissolved solids are convenient for comparing the quality of water from one time to another and from one place to another. Most drinking water contains between 50 and 500 mg/L of dissolved solids.

"Dissolved-solids discharge," expressed in tons per day, represents the total daily amount of dissolved minerals carried by the stream and is calculated by multiplying the dissolved-solids concentration (in mg/L) by the stream discharge (in cfs; times a unit conversion factor of .0027). Even though dissolved-solids *concentrations* are generally higher during periods of low streamflow than of high streamflow, the highest dissolved-solids *discharges* occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

WATER RESOURCES REVIEW

September 1977

Based on reports from the Canadian and U.S. field offices; completed October 7, 1977

EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for September based on 20 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for September 1977 is compared with flow for September in the 30-year reference period 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for September is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range*. In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the September flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of September. Water level in each key observation well is compared with average level for the end of September determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels*, unless described otherwise, are from the end of August to the end of September.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Reston, Virginia 22092.

ESTIMATED USE OF WATER IN THE UNITED STATES IN 1975

The abstract, graph, and table below are from the report, *Estimated use of water in the United States in 1975*, by C. Richard Murray and E. Bodette Reeves: U.S. Geological Survey Circular 765, 39 pages, 1977. This circular may be obtained free on request to Branch of Distribution, U.S. Geological Survey, 1200 S. Eads St., Arlington, VA 22202.

ABSTRACT

Estimates of water use in the United States in 1975 indicate that an average of about 420 bgd (billion gallons per day)—about 1,900 gallons per capita per day—was withdrawn for the four principal off-channel uses which are (1) public-supply (for domestic, commercial, and industrial uses), (2) rural (domestic and livestock), (3) irrigation, and (4) self-supplied industrial (including thermoelectric power). In 1975, withdrawals for these uses exceeded by 11.5 percent the 370 bgd estimated for 1970 (table 1). In computing total withdrawals, recycling within a plant (reuse) is not counted, but withdrawal of the same water by a downstream user (cumulative withdrawals) is counted. The quantity of freshwater consumed—that is, water made unavailable for further possible withdrawal because of evaporation, incorporation in crops and manufactured products, and other causes—was estimated to average 96 bgd for 1975 (fig. 1), an increase of about 10 percent since 1970. Estimates of water withdrawn from the principal sources indicated that 82 bgd came from fresh ground water, 1 bgd came from saline ground water, 260 bgd came from fresh surface water, 69 bgd came from saline surface water, and 0.5 bgd was reclaimed sewage.

The average annual streamflow—simplified measure of the total available water supply—is approximately 1,200 bgd in the conterminous United States. Total water withdrawn in 1975 for off-channel uses (withdrawals other than for hydroelectric power) amounted to about 34 percent of the average annual streamflow; 7.9 percent of the 1,200 bgd basic supply was consumed. However, comparisons of Water Resources Council regions indicate that the rate of withdrawal was higher than the locally dependable supply in the Mid-Atlantic, Missouri Basin, Texas-Gulf, Rio Grande, Lower Colorado, and California regions. Consumption amounted to nearly 24 percent of withdrawals in the conterminous United States; however, freshwater consumption amounted to only 6.5 percent of off-channel withdrawals in the 9 Eastern regions, which include the Mississippi and Souris Rivers, but to 44.2 percent in the 9 Western regions, ranging from 30 percent to nearly 70 percent. In the Rio Grande and Lower Colorado regions, freshwater consumption in 1975 continued to exceed the estimated dependable supply of freshwater.

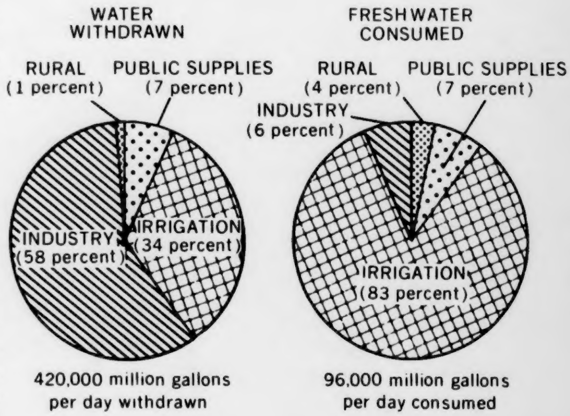


Figure 1.—Diagrams showing off-channel water withdrawals and freshwater consumed in 1975, by category.

Table 1.—*Changes in water withdrawals and water consumed in the United States, in billion gallons per day, 1950–75*

[Partial figures may not add to totals because of independent rounding]

	1950	1955	1960	1965	1970	1975	Percent increase or decrease 1970–75[1]
Total population (millions)	150.7	164	179.3	193.8	[2]205.9	[3]217.5	5.6
Total withdrawals	200	240	270	310	370	420	11.7
Public supplies	14	17	21	24	27	29	7.9
Rural domestic and livestock	3.6	3.6	3.6	4.0	4.5	4.9	10.3
Irrigation	[4]110	110	110	120	130	140	10.9
Self-supplied thermoelectric power use	[5]40	72	100	130	170	190	18.0
Other self-supplied industrial use	[5]37	39	38	46	47	44	-5.6
Sources from which water was withdrawn							
Fresh ground water	34	47	50	60	68	82	21.7
Saline ground water	(6)	.65	.38	.47	1.0	1.0	-6.0
Fresh surface water	[7]160	180	190	210	250	260	5.1
Saline surface water	[7]10	18	31	43	53	69	30.9
Reclaimed sewage	(6)	.2	.1	.7	.5	.5	2.2
Water consumed by off-channel uses	(6)	(6)	61	77	[8]87	[8]96	9.9
Water used for hydroelectric power	1,100	1,500	2,000	2,300	2,800	3,300	20.7

[1] Calculated from original unrounded computer printout figures for the two years.
[2] Including Puerto Rico.
[3] Including Puerto Rico and Virgin Islands.
[4] Including an estimated 30 bgd in irrigation conveyance losses.
[5] Estimated distribution of 77 bgd reported by MacKichan (1951).
[6] Data not available.
[7] Distribution of 170 bgd of freshwater and saline water reported by MacKichan (1951).
[8] Freshwater only.